Limit the temperature of the grout to a maximum of 90°F (32°C) during mixing and pumping. If necessary, cool the grout mixing water.

517.05. METHOD OF MEASUREMENT.

Post-tensioning *(prestressing)* will be measured by the lump sum. The concrete for post-tensioned cast-in-place concrete structures will be measured under Section 509. The reinforcing steel for post-tensioned cast-in-place concrete structures will be measured under Section 511.

517.06. BASIS OF PAYMENT.

The accepted quantities, measured as provided above, will be paid for at the contract price per unit of measurement for the pay item listed below if shown in the bid schedule. Payment will be full compensation for the work prescribed in this Section. Payment will be made under:

(A) PRESTRESSING ..... LUMP SUM

SECTION 520

STRUCTURAL CONCRETE REPAIR BY SEALING AND INJECTION

520.01. DESCRIPTION.

This work shall consist of structurally rebonding cracks, delaminations and hollow planes in Portland cement concrete structures and restoring the structural integrity of the concrete by injecting and sealing the cracks in the structure with an epoxy resin system as shown on the contract documents or as directed by the Engineer.

520.02. MATERIALS.

(a) **Injection Ports.** Injection ports shall be tubes, fittings, pressure plates or other suitable devices to serve as an entry port for accepting the epoxy resin system under injection pressures of 60 psi (0.4 MPa) . Provide suitable means for sealing each port after completing injection of the port.

(b) **Crack Sealer.** Provide a sealing compound as recommended by the epoxy resin manufacturer that is suitable for sealing cracks in concrete members and anchoring the injection ports during the injection and curing of the epoxy resin system.

(c) **Pressure Plates.** Pressure plates may be used instead of sealing compound. The pressure plates must be made of clear plastic and shall be cut to appropriate lengths, widths and shapes to cover the cracks adequately.

(d) **Epoxy Resin System.** The epoxy resin system shall be a non-shrink, 100% solid, two-component, moisture-insensitive material formulated for pressure injection. The mixed epoxy system shall meet the requirements in Table 520-1.

(e) **Packaging and Labeling.** Each container shall be clearly labeled with the product name, component designation ("A" and "B"), manufacturer's name, batch number ratio of component mixture, complete instructions for storing, mixing, using and all applicable safety requirements. Component "A" and "B" shall be packaged in suitable separate containers of a size that when mixed, a specified quantity of properly proportioned material will be produced.

Table 520-1
Epoxy Requirements

Characteristic	Required Value
Slant Shear Strength	3000 psi minimum , when bonded to saturated, dry surface at 40°F and 90-100% humidity. Test Method: AASHTO T-237 Note: Joint width of 1/8 inch will be used for testing purposes.
Set Time	18 hours maximum Test Method: AASHTO T-237
Pot Life	10 minutes minimum Test Method: AASHTO T-237
Viscosity	250-900CPS Brookfield #3 Spindle 60 RPM at 77°F after mixing for 3 minutes at slow speed Test Method: ASTM D-2196
Specific Gravity	1.1 minimum at 77°F

Table 520-1 (Metric)
Epoxy Requirements

Characteristic	Required Value
Slant Shear Strength	20 MPa minimum , when bonded to saturated, dry surface at 4°C and 90-100% humidity. Test Method: AASHTO T-237 Note: Joint width of 3mm will be used for testing purposes.
Set Time	18 hours maximum Test Method: AASHTO T-237
Pot Life	10 minutes minimum Test Method: AASHTO T-237
Viscosity	250-900CPS Brookfield #3 Spindle 60 RPM at 25°C after mixing for 3 minutes at slow speed Test Method: ASTM D-2196
Specific Gravity	1.1 minimum at 25°C

(f) **Sampling and Testing.** Submit samples of each batch of material proposed for use to the Engineer at least 30 days before date of usage to allow for completion of testing.

520.03. EQUIPMENT.

To inject epoxy, use a pressure pot, hand pump, caulking device, injection machine or other special device that is compatible with the material used.

Where pressure plates have been used to seal the cracks, use a special pressure fitting on the injection device to prevent leakage when injecting the epoxy resin through the $^{1}/_{4}$ inch (6 mm) holes in the pressure plates.

Use drilling equipment (for drilling the injection ports) equipped with a vacuum system to prevent drilling dust from compacting into the cracks or laminations and blocking the injection and sealing effort.

520.04. CONSTRUCTION METHODS.

(a) **Preparation.** Clean the surfaces adjacent to cracks of existing efflorescence, deteriorated concrete and other surface debris. Wherever feasible, clean the interior surfaces of the crack to enhance adhesive bond. Clean by vacuuming, flushing, sawing or other approved means.

Widen all cracks to be repaired to $^{1}/_{4}$ inch (6 mm) at the concrete surface. Seal with a quick-setting material to bond the injection ports and prevent loss of the injected resin. Sealing with a clear plastic plate to prevent loss of the injected resin may be permitted. Apply the seal so the concrete surface will not be defaced and the seal can contain the pumped resins.

(b) **Epoxy Resin Injection.** Space the entry ports for the resin so that travel of material between ports is assured. Begin injection at the lower port and continue until siting the resin at the entry port directly above or adjacent to the port being pumped. When material travel is indicated, move the nozzle to the port showing resin and seal the previously pumped port. Continue this procedure until the crack is completely filled. On wide cracks, where travel of the resin between ports will be rapid, two or more ports may be pumped simultaneously.

(c) **Leveling of Surface Seal.** After completing injection of the cracks and allowing necessary curing time for the resin, grind all surface areas until flush with the concrete surface.

(d) **Clean Up.** Clean the areas repaired on a daily basis.

520.05. METHOD OF MEASUREMENT.

Repair of structural concrete by the sealing and injection of the cracks will be measured on the surface by the linear foot (meter) *preparation of cracks* above and below water and by the gallon (liter) of *epoxy resin* injected into the cracks above and below water.

520.06. BASIS OF PAYMENT.

The accepted quantities, measured as provided above, will be paid for at the contract price per unit of measurement for the pay item listed below if shown in the bid schedule. Payment will be full compensation for the work prescribed in this Section. Payment will be made under:

(A) PREPARATION OF CRACKS, ABOVE WATER ..... LINEAR FOOT (METER)
(B) PREPARATION OF CRACKS, BELOW WATER ..... LINEAR FOOT (METER)
(C) EPOXY RESIN, ABOVE WATER ..... GALLON (LITER)
(D) EPOXY RESIN, BELOW WATER ..... GALLON (LITER)

SECTION 521
PNEUMATICALLY APPLIED MORTAR

521.01. DESCRIPTION.

This work consists of furnishing and placing of pneumatically applied mortar for the construction of portions of structures, repairing concrete structures, texturing concrete surfaces, encasement of structural steel members, lining ditches and channels, paving slopes and for other miscellaneous work, all as specified in the contract documents.

This work shall also include the preparation of surfaces to receive the mortar and the furnishing and placing of any reinforcing steel and the anchors for reinforcement.

Pneumatically placed mortar shall consist of either dry mixed fine aggregate and Portland Cement pneumatically applied by a suitable mechanism, to which mixture the water is added immediately before its expulsion from the nozzle, or mortar premixed by mechanical methods and pneumatically applied through a nozzle onto the prepared surface.

521.02. MATERIALS.

(a) **General.** Provide materials conforming to the following subsections, except as otherwise specified:

Fine Aggregate	701.05
Coarse Aggregate	701.06
Water	701.04
Portland Cement	701.02
Reinforcing Steel for Structures	723.01
Wire Mesh	723.03

Use fine aggregate only, or a combination of fine and coarse aggregates with the percentage of coarse aggregate to total aggregate not exceeding 30%. Coarse aggregate, if used, shall conform to AASHTO M43, No. 8 or 89 gradation. Recovered rebound which is clean and free of foreign material may be reused as fine aggregate in quantities not to exceed 20% of the total fine aggregate requirements.